

SCHIFF BASE LIGAND ITS COMPLEXES AND THEIR FT-IR SPECTROSCOPY STUDIES

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Abstract

The present study investigation is preparation of Schiff base ligand furfural-Ethylene diamine, its complexes with Cobalt(II) Nickel(II), Copper(II) and Zinc(II) . Schiff base metal complexes having insecticidal, fungicidal and herbicidal applications operate as ligands. Here we characterized by their FTIR spectroscopy.

Key words: Schiff base Cobalt(II) Nickel(II), Copper(II) , Zinc(II), Coordination Chemistry, Ligands

I. INTRODUCTION

Schiff bases are having special interest. Schiff bases, named after its inventor Schiff, are formed by the condensation of primary amine with an active carbonyl compound.

They have an azomethine group $-RC=NR'$, where R and R' are alkyl, cycloalkyl, aryl or heterocyclic group. The presence of a lone pair of electron in the sp^2 hybridised orbital on the imino nitrogen atom makes the azomethine group more significant chemically and biologically. Schiff bases with an additional donor atom closer to the imino nitrogen form stable chelate with many metal ions.

In the coordinate chemistry field, a lot of Schiff bases operate as ligands . Some of the Schiff bases complex combinations with metals are used as insecticides, fungicides, herbicides .Nitro and halo derivatives of Schiff bases are reported to have antimicrobial and antitumor activities . Antimicrobial and antifungal activities of various Schiff bases have also been reported .Many Schiff bases are known to be medically important and are used

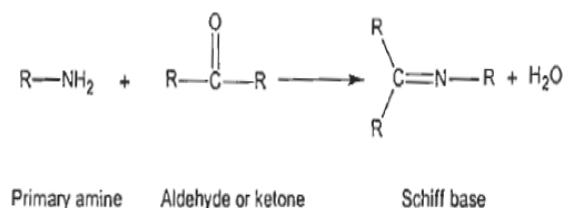
II. MATERIALS AND METHODS

The chemicals, Furfural, ethylene diamine were bought in pure form from Loba Chemie. They were used as such. The metal salts, Cobalt(II) sulphate, Nickel(II) sulphate, Copper(II) sulphate and Zinc(II) sulphate were Analar grade chemicals from Himedia

A. Preparation of Schiff base ligand

One millimole of furfural and one millimole of ethylene diamine were taken in a semi micro boiling tube. The tube was sealed with cotton and placed inside a conical flask. It was placed inside the microwave oven and heated for 5 minutes. The Schiff base ligand formed was washed with ethanol and then with ether and dried. The yield was found to be 95%.

B. Preparation of Schiff base complex



Two millimole of the Schiff base ligand and one millimole of cobalt(II) sulphate were mixed in a semi micro boiling tube. It is placed inside a conical flask and heated in the microwave oven for 5 minutes. The Schiff base complex formed was washed with ethanol and then with ether and dried. The yield was 96%.

From the Schiff base ligand furfural-Ethylene diamine, its complexes with Cobalt(II) Nickel(II), Copper(II) and Zinc(II) were prepared by identical method.

C. Spectral Characterization

The two Schiff base ligands prepared and the eight complexes synthesised were characterised by FTIR

spectroscopy. The IR Spectra was recorded for all the sample, using Fourier Transform Infrared Spectroscopy (FTIR)-model No-4100 type A Serial No.C193061016.

III. RESULTS AND DISCUSSION

The spectral characteristics and other analytical parameters of the Schiff base ligands and their complexes have been discussed. The Schiff base complexes synthesised by solvent free microwave method are stable towards air. It is soluble in common organic solvents like ethanol, methanol, DMF etc.

FTIR spectroscopy.

A. Furfural(A) -Ethylene diamine(B) System

The FTIR spectrum of the Schiff base ligand, furfuralidene ethylene diamine is given in the Fig.1. The spectrum exhibit the following characteristic absorption

The absorption at 3123.15cm^{-1} and 2927.41cm^{-1} can be attributed to the primary amino group. This shows that one of the amino groups in ethylene diamine is free, while the other forms Schiff base with furfural, The IR spectrum of the Schiff base ligand furfural-ethylene diamine shows absorption band at 3123.15cm^{-1} which may be due to the C-O-C stretching, The absorption band at 1648.81cm^{-1} is due to the C=N imino stretching vibrations, and confirms the formation of Schiff bases, The medium absorption band at 1339cm^{-1} , 1143.58cm^{-1} , 1012cm^{-1} is due to skeletal vibration, i.e., C-C stretching in phenyl nucleus, The sharp absorption bands at 731.853cm^{-1} is due to aromatic furan moiety.

The above frequencies confirm the structure of the Schiff base ligand, prepared by solvent free synthesis, viz. Furfuralidene ethylene diamine.

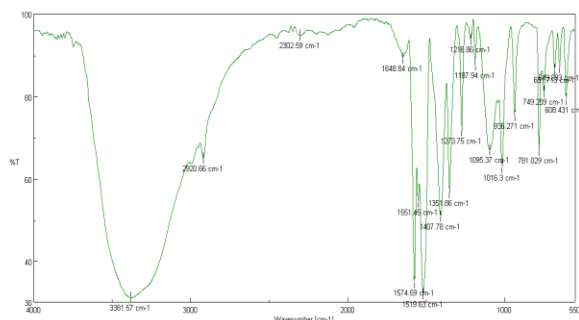


Fig. 1 FTIR Spectrum of Schiff base ligand AB (furfural – ethylene diamine)

B. Cobalt(II)-furfural(A)-ethylenediamine(B) system

The FTIR spectrum of the Schiff base complex CoAB, is given in the Fig.2. The spectrum exhibit the following characteristic absorption.

The absorption at 3334.32cm^{-1} can be attributed to the primary amino group. This corresponds to that of the amino group in ethylene diamine. The IR spectrum of the complex shows absorption band at 3300cm^{-1} which may be due to the -OH group. The strong absorption at 1621.84cm^{-1} is due to C=N imino stretching vibrations.

This is also shifted to a lower value than that of the free ligand (1648.81cm^{-1}) confirming the coordination of the imino nitrogen to the Co(II) ion. The medium absorption band at 1317.14cm^{-1} is due to skeletal vibration i.e. C-C stretching in phenyl nucleus. The sharp absorption band at 1117.55cm^{-1} , 1040.41cm^{-1} , 815.742cm^{-1} due to C-N bending vibrations.

The above frequencies confirm the structure of the Schiff base complex CoAB, prepared by solvent free synthesis.

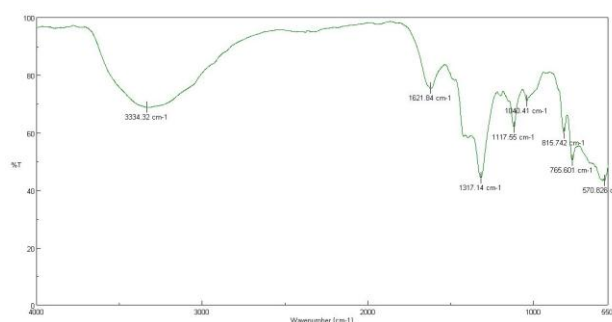


Fig.2 FTIR Spectrum of Schiff base complex CoAB

C. Nickel(II)-furfural(A)-ethylene diamine(B) system

The FTIR spectrum of the Schiff base complex NiAB, is given in the Fig.3. The spectrum exhibit the following characteristic absorption. The absorption at 3193.54cm^{-1} can be attributed to the primary amino group. This corresponds to that of the amino group in ethylene diamine. The IR spectrum of the complex shows absorption band at 3193.54cm^{-1} which may be due to the -OH group. The strong absorption at 1634.38cm^{-1} is due to C=N imino stretching vibrations.

This is also shifted to a lower value than that of the free ligand (1648.81cm^{-1}) confirming the coordination of the imino nitrogen to the Ni(II) ion. The medium

absorption band at 1077.05 cm^{-1} is due to skeletal vibration i.e. C-C stretching in phenyl nucleus. The sharp absorption band at 1077.05 cm^{-1} due to C-N bending vibrations. The above frequencies confirm the structure of the Schiff base complex NiAB, prepared by solvent free synthesis.

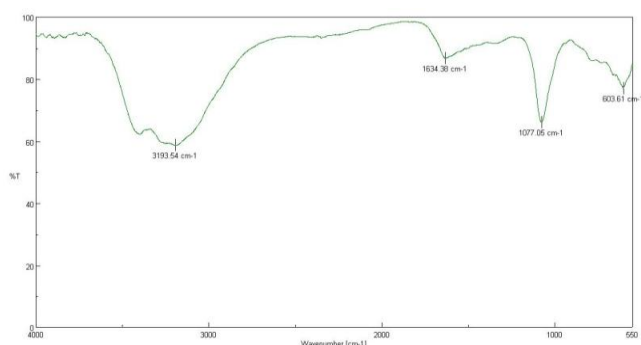


Fig. 3 FTIR Spectrum of Schiff base complex NiAB

D. Copper(II)-furfural(A)-ethylenediamine(B) system

The FTIR spectrum of the Schiff base complex CuAB, is given in the Fig.4. The spectrum exhibit the following characteristic absorption. The absorption at 3344.93 cm^{-1} can be attributed to the primary amino group. This corresponds to that of the amino group in ethylene diamine. The IR spectrum of the complex shows absorption band at 3344.93 cm^{-1} which may be due to the -OH group.

The strong absorption at 1579.41 cm^{-1} is due to C=N imino stretching vibrations. This is also shifted to a lower value than that of the free ligand (1648.81 cm^{-1}), confirming the coordination of the imino nitrogen to the Cu(II) ion. The medium absorption band at 1145.51 cm^{-1} and 1012.45 cm^{-1} is due to skeletal vibration, i.e., C-C stretching in phenyl nucleus. The sharp absorption band at 1145.51 cm^{-1} and 1012.45 cm^{-1} is due to C-N bending vibrations. The above frequencies confirm the structure of the Schiff base complex CuAB, prepared by solvent free synthesis.

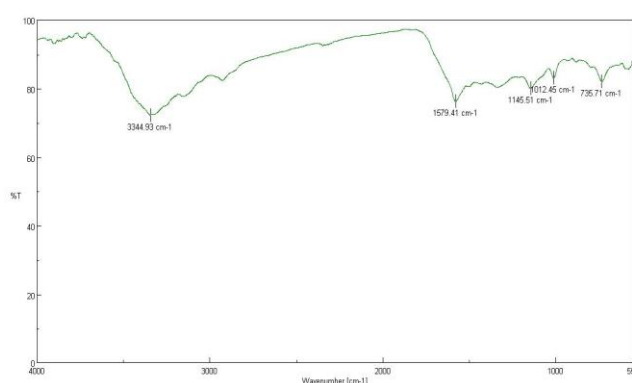


Fig.4 FTIR Spectrum of Schiff base complex CuAB

E. Zinc(II)-furfural(A)-ethylene diamine(B) system

The FTIR spectrum of the Schiff base complex ZnAB, is given in the Fig.5. The spectrum exhibit the following characteristic absorption. The absorption at 3843.43 and 3396.03 cm^{-1} can be attributed to the primary amino group. This corresponds to that of the amino group in ethylene diamine. The IR spectrum of the complex shows absorption band at 3396.03 cm^{-1} which may be due to the -OH group. The strong absorption at 1614.13 cm^{-1} is due to C=N imino stretching vibrations.

This is also shifted to a lower value than that of the free ligand (1648.81 cm^{-1}), confirming the coordination of the imino nitrogen to the Zn(II) ion. The medium absorption band at 1428.99 cm^{-1} is due to skeletal vibration i.e. C-C stretching in phenyl nucleus. The sharp absorption band at 1329.68 cm^{-1} and 1130.08 cm^{-1} due to C-N bending vibrations. The above frequencies confirm the structure of the Schiff base complex ZnAB, prepared by solvent free synthesis.

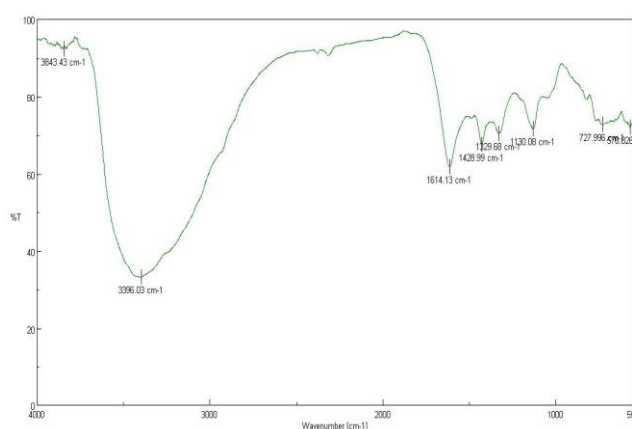


Fig.5 FTIR Spectrum of Schiff base complex ZnAB

IV. CONCLUSION

The Schiff base ligand and Schiff base complex prepared and characterized by FT-IR Spectroscopy. The Schiff base ligand prepared by solvent free synthesis, viz. Furfuralidene ethylene diamine. Schiff base complex are CoAB, NiAB, Cu AB, ZiAB also prepared by solvent free synthesis.

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